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October 6, 2010

10 CFR 50.73

SVP-10-066

U. S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, D.C. 20555

Quad Cities Nuclear Power Station, Unit 1  
Renewed Facility Operating License No. DPR-29  
NRC Docket No. 50-254

Subject: Licensee Event Report 254/2010-002-00, "Unit 1 Reactor Scram Due to Turbine Trip from Low Condenser Vacuum During Main Condenser Flow Reversal"

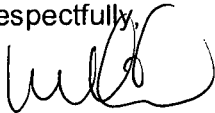
Enclosed is Licensee Event Report (LER) 254/2010-002-00, "Unit 1 Reactor Scram Due to Turbine Trip from Low Condenser Vacuum During Main Condenser Flow Reversal," for Quad Cities Nuclear Power Station, Unit 1.

This report is submitted in accordance with the requirements of the Code of Federal Regulations, Title 10, Part 50.73(a)(2)(iv)(A), which requires the reporting of any event or condition that resulted in manual or automatic actuation of the reactor protection system (RPS) including reactor scram or reactor trip.

There are no regulatory commitments contained in this letter.

Should you have any questions concerning this report, please contact Mr. W. J. Beck at (309) 227-2800.

Respectfully,



William R. Gideon  
Site Vice President  
Quad Cities Nuclear Power Station

cc: Regional Administrator – NRC Region III  
NRC Senior Resident Inspector – Quad Cities Nuclear Power Station

JE22  
MR

## LICENSEE EVENT REPORT (LER)

(See reverse for required number of  
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

<b>1. FACILITY NAME</b> Quad Cities Nuclear Power Station Unit 1					<b>2. DOCKET NUMBER</b> 05000254		<b>3. PAGE</b> 1 OF 5					
<b>4. TITLE</b> Unit 1 Reactor Scram Due to Turbine Trip from Low Condenser Vacuum During Main Condenser Flow Reversal												
<b>5. EVENT DATE</b>			<b>6. LER NUMBER</b>			<b>7. REPORT DATE</b>			<b>8. OTHER FACILITIES INVOLVED</b>			
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME		DOCKET NUMBER	
08	12	10	2010	002	00	10	06	2010	N/A		N/A	
<b>9. OPERATING MODE</b>  1			<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §:</b> (Check all that apply)									
<b>10. POWER LEVEL</b>  100%			<input type="checkbox"/> 20.2201(b) <input type="checkbox"/> 20.2203(a)(3)(i) <input type="checkbox"/> 50.73(a)(2)(i)(C) <input type="checkbox"/> 50.73(a)(2)(vii)									
			<input type="checkbox"/> 20.2201(d) <input type="checkbox"/> 20.2203(a)(3)(ii) <input type="checkbox"/> 50.73(a)(2)(ii)(A) <input type="checkbox"/> 50.73(a)(2)(viii)(A)									
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			<input type="checkbox"/> 20.2203(a)(2)(ii) <input type="checkbox"/> 50.36(c)(1)(ii)(A) <input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A) <input type="checkbox"/> 50.73(a)(2)(x)									
			<input type="checkbox"/> 20.2203(a)(2)(iii) <input type="checkbox"/> 50.36(c)(2) <input type="checkbox"/> 50.73(a)(2)(v)(A) <input type="checkbox"/> 73.71(a)(4)									
			<input type="checkbox"/> 20.2203(a)(2)(iv) <input type="checkbox"/> 50.46(a)(3)(ii) <input type="checkbox"/> 50.73(a)(2)(v)(B) <input type="checkbox"/> 73.71(a)(5)									
			<input type="checkbox"/> 20.2203(a)(2)(v) <input type="checkbox"/> 50.73(a)(2)(i)(A) <input type="checkbox"/> 50.73(a)(2)(v)(C) <input type="checkbox"/> OTHER									
			<input type="checkbox"/> 20.2203(a)(2)(vi) <input type="checkbox"/> 50.73(a)(2)(i)(B) <input type="checkbox"/> 50.73(a)(2)(v)(D)      Specify in Abstract below or in NRC Form 366A									
<b>12. LICENSEE CONTACT FOR THIS LER</b>												
FACILITY NAME Tom Petersen – Regulatory Assurance								TELEPHONE NUMBER (Include Area Code) (309) 227-2825				
<b>13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT</b>												
CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX			
B	KE	29	G080	Y								
<b>14. SUPPLEMENTAL REPORT EXPECTED</b>								<b>15. EXPECTED SUBMISSION DATE</b>		MONTH	DAY	YEAR
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO										N/A	N/A	N/A
<b>ABSTRACT</b> (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)												
<p>On August 12, 2010, Quad Cities Unit 1 performed a scheduled reversal of the direction of flow through the main condenser [KE]. During the flow reversal, two valves [ISV] failed to operate, resulting in low condenser vacuum. In response to the low condenser vacuum, the main turbine [TRB] tripped and the reactor [RCT] scrambled. There were no complications during the turbine trip and reactor scram, and all systems functioned as required.</p> <p>The root cause for this event was determined to be foreign material from the manufacturing process in an auxiliary contact unit [29] for the breaker [BKR] of one of the valves involved in the main condenser flow reversal process. This caused the valve to fail to open. A contributing cause to the event was the setpoint of a thermal overload [TS] for a separate main condenser flow reversing valve that did not anticipate the specific conditions of this event and caused this valve to trip at mid-position.</p> <p>The reactor and turbine responded as designed to the low condenser vacuum. Although the turbine trip occurred prior to the expected vacuum level, it was determined that this is due to the location of the instrument taps in the condenser for the turbine trip being at a higher elevation than the location of the instrument taps for the reactor protection system (RPS) [JD] and main control room [NA] indication.</p> <p>Corrective actions included auxiliary contact and thermal overload replacement and testing, procedure changes, and reviews for potential setpoint and design changes.</p> <p>The safety significance of this event was minimal. This event is reportable per 10 CFR 50.73(a)(2)(iv)(A), as any event or condition that resulted in manual or automatic actuation of the reactor protection system (RPS), including reactor scram or reactor trip.</p>												

**LICENSEE EVENT REPORT (LER)  
CONTINUATION SHEET**

U.S. NUCLEAR REGULATORY COMMISSION

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**NARRATIVE**

**PLANT AND SYSTEM IDENTIFICATION**

General Electric - Boiling Water Reactor, 2957 Megawatts Thermal Rated Core Power

Energy Industry Identification System (EIIIS) codes are identified in the text as [XX].

**EVENT IDENTIFICATION**

Unit 1 Reactor Scram Due to Turbine Trip from Low Condenser Vacuum During Main Condenser Flow Reversal

**A. CONDITION PRIOR TO EVENT**

Unit: 1	Event Date: August 12, 2010	Event Time: 0358 hours
Reactor Mode: 1	Mode Name: Power Operation	Power Level: 100%

**B. DESCRIPTION OF EVENT**

On August 12, 2010, a Unit 1 main condenser circulating water flow reversal was scheduled per procedure, Circulating Water System Flow Reversal. The circulating water flow was to be reversed from the south direction to the north direction. This activity received a pre-job brief. This pre-job brief included a discussion of the possibility that the valves would not operate as expected, and the actions to be taken if that occurred. These actions included taking the flow reversal switch [HS] back to the original position, dropping load using the reactor recirculation pumps [P], and stationing an Equipment Operator at motor control center (MCC) [BU] 16-3 to reset thermal overload (TOL) devices if required. A contingency manual scram value of 6.5 inches Hg backpressure was established in accordance with the guidance of procedure, Loss of Condenser Vacuum. Per procedural guidance, the initial backpressure was verified to be below 4.5 inches Hg, and low enough that it was not expected to exceed 5.5 inches Hg during the reversal. Initial backpressure was 4.2 inches Hg.

At approximately 0355 hours, the operator moved the circ water flow selector switch from the south position to the north position. The first half of the flow reversal (the west side of the condenser) was automatically completed as expected. Approximately 60 seconds after the main condenser flow reversal was initiated (approximately 30 seconds for valve movement on the first half, and a 30 second pause built into the logic), the second half of the reversal process started (the east side of the condenser). After approximately 45 seconds, an incomplete sequence alarm was received in the control room. The Control Room Operator identified that motor operated valve (MOV) [20] 1-4402D had failed to open as required. At this point, the west side of the condenser had full flow in the north direction, and the east side did not have any flow with both inlet valves closed. In accordance with procedural guidance and contingency actions discussed in the pre-job brief, the Control Room Operator then placed the circ water flow selector switch back to south in an attempt to restore circulating water flow to the east side of the main condenser and recover its heat transfer capability.

During the first half (west side) of this emergency flow reversal (returning flow to its original condition), MOV 1-4403B failed to completely open, and both indicating lights (open and closed) went off. Since the incomplete sequence alarm was received during the repositioning of a valve on the west side (the first side to reposition on a flow reversal), the logic automatically stopped the sequence and the valves on the east side of the condenser (MOV 1-4402C and MOV 1-4403D) did not receive a signal to reposition. At this point the main condenser still had no flow through its east side, and the flow through its west side was now in the south direction but throttled by an outlet valve in mid-position.

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Operators attempted an emergency reactor/turbine power reduction in order to reduce the steam flow into the main condenser and preserve vacuum. However, at approximately 0358 hours the Unit 1 main turbine automatically tripped due to low main condenser vacuum (indicated 6.3 inches Hg condenser backpressure), and the Unit 1 reactor scrammed due to closure of the Unit 1 main turbine stop valves. Approximately 45 seconds after the second (emergency) circulating water flow reversal (return to the south direction) was initiated, a second incomplete sequence alarm was received in the control room.

This LER is being submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A), which requires the reporting of any event or condition that resulted in manual or automatic actuation of the RPS, including reactor scram or reactor trip.

**C. CAUSE OF EVENT**

The root cause for the turbine trip during main condenser flow reversal was determined to be foreign material (FM) introduced during the manufacturing process for the auxiliary contact unit used in the breaker associated with MOV 1-4402D. The auxiliary contact failure caused the MOV 1-4402D to fail to open.

The potential for introduction of the FM during the purchasing, transportation, storing, or installation of the auxiliary contacts, or during operation with the auxiliary contacts installed, was also examined. It was concluded that the sealed nature of the unit made these other handling periods much less likely than the introduction of the FM during manufacturing.

The recorder traces for condenser vacuum were also examined and it was determined that the failure of MOV 1-4402D was the primary driver for the event.

Failure of MOV 1-4403B was identified as a contributing cause of the event. The complex troubleshooter for MOV 1-4403B identified that the valve failed approximately halfway through its open stroke due to the TOL tripping. The TOL was replaced and taken to the shop and bench-tested. It was determined that the TOL was appropriately set per the existing setpoint guidance.

For a typical MOV, the TOL setting would be such that repeat operation of the valve in a short time (within a few minutes) would increase the likelihood that the TOL would trip. Heating of the TOL occurs during the operation of the valve, and operating it quickly again does not provide sufficient time for the TOL to cool down, causing it to trip sooner on the second and each subsequent operation.

During the time of the event, the area around the breaker cubicle had an elevated temperature due to the higher outside ambient temperatures. Also, the specific failures involved in this event resulted in all three circulating water pumps operating such that the only path of circulating water available through the condenser was through the MOV 1-4403B. The complex troubleshooter concluded that it is reasonable and likely that the TOL would trip in this condition.

As a result, given that operating MOV 1-4403B a second time within a few minutes is a required function of the valve, it was determined that the cause of the TOL trip for MOV 1-4403B was the setpoint of the TOL did not anticipate the specific conditions of this event, and is hence considered a contributing cause for this event.

Tests were also performed on the MOV 1-4403B valve and actuator [84], and it was determined that neither had evidence of degradation.

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**NARRATIVE**

**D. SAFETY ANALYSIS**

The safety significance of this event was minimal. The reactor and turbine responded as designed to the low condenser vacuum. There were no complications during the turbine trip and reactor scram, and all systems functioned as required.

Although the turbine trip occurred prior to the expected vacuum level, it was determined that this is due to the location of the instrument taps in the condenser for the turbine trip being at a higher elevation than the location of the instrument taps for the RPS and main control room indication. Specifically, there are two sets of instrument taps in the condenser. The instrument taps that feed the turbine trips are located near the top of the condenser at the skirt. The instrument taps that feed the RPS Instrumentation are lower in the condenser. Due to differences in elevation and event characteristics, the turbine trip in response to the low vacuum in this event occurred at a higher indicated vacuum (lower indicated backpressure) than anticipated by the operators. This issue, however, did not contribute to the scram.

**E. CORRECTIVE ACTIONS**

**Immediate:**

- MOV 1-4402D auxiliary contacts replaced
- MOV 1-4403B TOL replaced and tested.
- MOV 1-4403B valve and actuator tested for degradation.
- All Unit 1 and Unit 2 main condenser reversing valve auxiliary contacts tested.
- On-shift training was provided to the Operators concerning main condenser vacuum readings.
- Temporary procedure change made to lower contingency manual scram criteria from 6.5 to 6.0 inches Hg backpressure.

**Follow-up:**

- Implemented testing of auxiliary contact units prior to installation in main condenser reversing valve breakers.
- Procedure change was implemented to require verifying contact integrity prior to reversing flow.
- The thermal overloads for the main condenser reversing valves will be reviewed for potential changes to setpoints or design.
- Training and procedure changes will be implemented to communicate the potential disparity between the turbine trip vacuum reading and the RPS vacuum reading.
- Review for potential modification of the RPS and turbine trip vacuum taps such that they read the same.
- Replace all Unit 1 and Unit 2 main condenser reversing valve auxiliary contacts.

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**NARRATIVE**

**F. PREVIOUS OCCURRENCES**

The Station Events Database, EPIX, NPRDS, and LERs were reviewed for similar events. This event was caused by FM from the manufacturing process identified in the auxiliary contact unit for the breaker associated with the valve MOV 1-4402D. There were no prior incidents identified involving a turbine trip or reactor scram due to low vacuum during main condenser flow reversal at Quad Cities.

- Station Events Database – Quad Cities Investigation Report (IR) 106653 - MO 1-4402B Condenser Flow Reversing Valve Stuck Mid-Position (5/3/02) – The apparent cause was determined to be “extreme wear of the ring gear in the Limitorque SMB-3 actuator.” Corrective Actions included generating preventive maintenances (PMs) to replace the flow reversing valve actuators as a task every four years, and PMs to obtain current trace data on flow reversing valve actuators annually. Corrective actions were, however, applied to minimizing actuator degradation as appropriate, and did not involve the auxiliary contact unit for the breaker as identified in this LER.
- EPIX/ NPRDS – No similar events identified for Quad Cities.
- LERs - No similar events identified for Quad Cities.

**G. COMPONENT FAILURE DATA**

This event has been reported to EPIX as Failure Report No. 1062.

The component that failed was a General Electric CR305X auxiliary contact unit.